

PROCEEDINGS 92ND ANNUAL MEETING

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pro-opiomelanocortin (POMC). Lastly, in the LH isolated from GnIH-injected chicks, there was an increase expression of melanin-concentrating hormone (MCH). Thus, the orexigenic effects of GnIH appear to involve the LH and affect NPY, POMC, and MCH. Supported by Virginia Academy of Sciences Undergraduate Grant Award.

THE SCIENCE OF VIRGINIA'S AQUACULTURE FEED PRICES. Brian L. Nerrie, Virginia Cooperative Extension, Virginia State University, Petersburg, VA 23806. Aquaculture feed costs are between 50-60% of the operating expenses. Aquaculture's growth has resulted from improved knowledge of the nutritional requirements of aquacultured products. Initially nutrients were supplied by natural pond foods, and later by enhanced fertilization to improve pond productivity. Aquaculture feeds were developed that enabled farmers to provide uniform-size products to satisfy consumer demand for high quality affordable protein. Small changes in feed prices result in larger influences on product cost. Feed grains are a major component of aquaculture feeds. Increases in feed prices have resulted from alternative uses of acreage used for feed grain production especially biofuel development, decreased supply due to international demand for feed grains and local transportation costs. Economies of size in Virginia's aquaculture industry add to prices.

Astronomy, Mathematics, and Physics with Material Science

CALCULATION OF THE ELECTRON MASS FROM ITS FIELDS. J. D. Rudmin, The College of Integrated Science and Engineering, James Madison University, Harrisonburg, VA 22807. The masses of the three flavors of the electron are calculated from the electroweak fields. A normal charge distribution provides field reduction at short range. Lagrange's equations are solved exactly or by polynomial approximation (The Parker-Sochacki method). If a term is included which has the form of a magnetic moment, with the mass of the W for the mass of the magnetic moment, then the electron, muon, and tau have evenly spaced masses in natural units. The even spacing of mass suggests that the electron has one unit of flavor that couples to the Higgs field like a spin-1 magnetic moment couples to a magnetic field. The electron then adjusts its size for a self-consistent mass. Since the electron is a fermion, it would contribute 1/2 unit of flavor. Perhaps the local direction of time contributes the additional 1/2 unit of flavor.

TEMPERATURE-AND TIME-RESOLVED SPECTROSCOPY OF CuUnS₂ SEMICONDUCTOR NANOCRYSTALS WITH ZnS CAPPING. Quinton Rice¹, Sangram Raut², Ignacy Gryczynski², Zygmunt Gryczynski², Bagher Tabibi¹, & Jaetae Seo¹, ¹Advanced Center for Laser Science and Spectroscopy, Department of Physics, Hampton University, Hampton, Virginia 23668 and ²Center for Commercialization of Fluorescence Technologies, Department of Cell Biology, University of North Texas Health Science Center, Fort Worth, Texas 76107. Semiconductor nanocrystals (SNCs) have been a prominent research area for photonic applications of optoelectronic devices, light emitting devices (LEDs), and biomedical applications due to their high quantum yield, wide tunability, and ability to be integrated with micro-photonic and electronic devices. Also, the SNCs of CuInS₂ do not possess intrinsic toxicity

associated with those of heavy metals such as cadmium or lead chalcogenide which limit practical biomedical applications. Generally, the SNCs with sizes near the bulk Bohr radius display quantum characteristics which are confirmed by the strong optical blue-shift from the band gap of bulk materials and the discrete energy states that develop from confined electron-hole pairs within the size limit of the nanocrystal. The SNCs are highly sensitive to morphology, composition, and lattice strains or defects in the structure. This work includes time-resolved and temperature-dependent optical properties that revealed several characteristics linked to surface-trapped state recombination and shallow or deep defect related donor-acceptor transitions which are widely distributed throughout the entire emission spectra. The temperature-resolved photoluminescence showed that the emission from surface-trapped and interface-trapped transitions remained thermally active at low temperatures while emissions from intrinsic defect related transitions were strongly quenched due to their stability from the Coulomb interaction. Acknowledgement: This work at HU is supported by NSF HRD-1137747 and ARO W911NF-11-1-0177.

TIME-RESOLVED COLORIMETRIC FLOCCULATION AND SURFACE-ENHANCED RAMAN SCATTERING OF MOLECULE-LINKED PLASMONIC NANOPARTICLES. A. Hayes,¹ Q. Rice,¹ M. Abdel-Fattah,¹ W. Kim,² S. Jung,³ B. Tabibi,¹ & J. Seo,¹ Advanced Center for Laser Science and Spectroscopy, Department of Physics, Hampton University, Hampton, Virginia 23668, U.S.A, ²Biosensor Research Team, Electronics and Telecommunications Research Institute, Daejeon 305-700, South Korea and ³Korea Research Institute of Standards and Science, Daejeon 305-600, South Korea. Surface-enhanced Raman spectroscopy (SERS) has been of great interest because of large enhancement of molecule Raman scattering under strong plasmonic field. The SERS provides the finger print of molecule information with signal enhancement. The colorimetric flocculation indicates the molecule linkages on the plasmonic nanoparticles. The spectral coupling between the localized surface plasmonic resonance (LSPR) at longer wavelength and laser frequency efficiently excites the Raman molecules. The molecule-linked plasmonic nanoparticles form a hot spot where the Raman analytes are located. The Au nanoparticles are prepared with average diameters of ~5, ~10, ~15, ~20, ~30, ~32, ~35, and ~40 nm within the plasmonic dipole approximation at the optical spectral region. The time-SERS is for 0, 2, 5, 10, 20, 30, 60, 120 and 180 minutes after the molecule was mixed with plasmonic particles. The colorimetric flocculation of molecule-linked plasmonic particles was monitored at same time. This presentation includes colorimetric flocculation and SERS of molecule-linked plasmonic particles with synthetic urine for biomedical applications. Acknowledgement: The work at HU was supported by NSF HRD-1137747 and ARO W911NF-11-1-0177.

MULTI-WAVELENGTH ANALYSIS OF THE EMPIRICAL SERKOWSKI RELATIONSHIP FOR INTERSTELLAR POLARIZATION. G.E. Matthews & G.A. Topasna, Department of Physics and Astronomy, Virginia Military Institute, Lexington, VA 24450. Using broadband filters, the wavelength dependence of polarization in the visual is described by the Serkowski relationship $p(\lambda)/p_{\max} = \exp[-K \ln^2(\lambda_{\max}/\lambda)]$ where $K \approx 1.7\lambda_{\max}$ and is empirically well-established for stellar observations. We confirmed the validity of the Serkowski relationship for stellar observations using narrowband

filters by making polarimetric observations of the star HD 197770 using both narrowband ($\Delta\lambda \sim 10$ nm) and Johnson-Cousins UBVRI broadband ($\Delta\lambda \sim 100 - 200$ nm) filters. The wavelength dependence of polarization for the two different filter sets was found and a nonlinear least square fit to the Serkowski relationship determined the maximum degree of polarization, p_{\max} , and the wavelength of maximum polarization, λ_{\max} . We found that the broadband filters had a maximum polarization of 4.14 ± 0.02 % at a wavelength of 527 ± 2 nm and the narrowband filter's maximum polarization was 4.033 ± 0.023 % at 532 ± 6 nm. The percent difference between broad and narrow band filters was 0.88% and the difference between their maximum polarizations was on the order of the instrumental polarization at 0.1%. Our findings show narrowband filters exhibit an identical Serkowski relationship to broadband filters. This is significant because it allows astronomers to now utilize the smaller band-pass of narrowband filters to image stars in regions of high nebulosity, producing more accurate and precise images than broadband filters are capable of.

EXTINCTION IN DISCRETE COMPETITIVE MULTI-SPECIES PATCH MODELS. D. M. Chan, M. D. McCombs, S. Boegner, H. J. Ban & S. Robertson, Department of Mathematics & Applied Mathematics, Virginia Commonwealth University, Richmond, VA 23284. In this paper, we extend the results of Franke and Yakubu for extinction in discrete competitive patch models. For a system of n species on m patches, we define conditions under which one species is a "superior competitor" to another and show that it is sufficient for one species to drive another to extinction. We also illustrate the result with an example for three species on three patches.

INFRARED AND THERMOELECTRIC POWER GENERATION IN THIN ALD THERMOELECTRIC FILMS. Harkirat S. Mann¹, Brian N. Lang¹, Yosyp Schwab¹, Janne Niemelä², Maarit Karppinen & Giovanna Scarel¹, ¹James Madison University, Department of Physics and Astronomy, Harrisonburg, VA 22807, USA ²Aalto University, Department of Chemistry, FI-00076 Aalto, Finland. A mechanism for alternative energy, thermoelectric (TEC) power generation, converts a temperature difference across two junctions into an electric potential. Although not as energy-efficient as solar panels or wind turbines, this mechanism is used in a wide variety of fields, e.g. to recapture waste heat. Recently it was discovered that a solid state TEC power generators respond differently to heat or infrared (IR) radiation. To test the robustness of this finding, this research compares TEC and IR power generation in the case of a nanometric TEC device in which the active element is a thin TEC film. The thin TEC film is a 70 nm thick n-type Nb-doped titanium oxide film deposited by atomic layer deposition (ALD) onto a borosilicate glass substrate. The interactions observed with heat show a linear relationship between temperature and voltage, whereas in IR radiation this linear relationship is broken down.

Posters

FABRICATION, CHARACTERIZATION, AND CONTROLLED ASSEMBLY OF POLYSTYRENE BASED JANUS PARTICLES. D. M. Topasna & G. A. Topasna, Department of Physics and Astronomy, Virginia Military Institute, Lexington, VA 24450. We present results on fabrication and controlled assembly of Janus particles.

The Janus particles were fabricated from 21 μm polystyrene spheres deposited on glass slides and covered with a top aluminum thin film. These Janus particles were then deposited in a specially fabricated cell and their alignment was controlled with AC electric fields at low frequency of 50 Hz.

POLARIMETRIC OBSERVATIONS OF HD 197770. G. A. Topasna, Department of Physics and Astronomy, Virginia Military Institute, Lexington, VA 24450. Observations of the polarized star HD 197770 were made in the V band using the optical polarimeter on the 0.5 meter telescope at the Virginia Military Institute observatory located at McKethan Park in Lexington, VA. Observations of other standard stars were made for comparison of the degree of polarization and the polarization position angle. The analysis shows that the HD 197770 shows less variability than the other standards stars. The mean values of the normalized Stokes parameters q and u were analyzed and the null hypothesis of equality of population means was tested using the Welch test. The weighted average of the normalized Stokes parameters were used to calculate the degree polarization and position angle and found to be $4.087 \pm 0.003 \%$ and $131.16 \pm 0.05^\circ$ respectively. Given the stability of HD 197770 we recommend that it be studied further across multiple wavelengths for possible use as a secondary standard star.

OPEN SOURCE TEXTBOOKS. Thomas C. Mosca III, Rappahannock Community College, Department of Mathematics, Warsaw, VA 22572. With textbooks costing hundreds of dollars per class, there is considerable motivation to examine “open educational resource” (OER) materials. This presentation provides a brief introduction to open source teaching materials for math and physics classes, and touches briefly on copyright. The purpose of this talk is more to stimulate discussion of the pros and cons, and also to solicit sources from members of the audience, for the benefit of other members.

Biology with Microbiology and Molecular Biology

INTIMATE ATTACHMENT: THE INTIMIN STORY OF PATHOGENESIS. Abigail Lenz, Department of Biology and Chemistry, Liberty University, Lynchburg VA 24502. Enterohemorrhagic *Escherichia coli* (EHEC) is a bacterium causing of mortality via hemolytic uremic syndrome. The virulence EHEC causes in humans is modeled in mice with *Citrobacter rodentium* (CR), which is a normal murine pathogen causing transmissible murine colonic hyperplasia but is not pathogenic to humans. The two most widely used strains of CR are ICC168 and DBS100, but only ICC168 has been sequenced. Therefore, genetic differences between these widely used strains have yet to be determined. We sequenced DBS100 and found it to be different from its presumably clonal ancestor by almost 400,000 nucleotides. Colonization strategies are thought to be among genetic difference in strains of CR. The process of attachment is important to colonization and involves adhesins, the primary of which is intimin in EHEC and CR. An intimin mutation divorces attachment from pathogenesis in colonization, thus addressing the importance of competition in pathogenesis. Similarly, the introduction and removal of antibiotics in the course of colonization creates a